

CLAIMS

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1 - Method for preparing cross-linked and/or functionalized bitumen/polymer compositions with a low susceptibility to temperature, wherein, when operating at temperatures that range between 100°C and 230°C and under agitation, we form a homogenous mass that represents the bitumen/polymer composition and is made of a bituminous matrix in which is uniformly dispersed a cross-linked and/or functionalized elastomer, made from a precursor elastomer used in a quantity that ranges between 0.5% and 30% of the weight of the bituminous matrix, where said method is characterized in that we made the bituminous matrix by associating, by weight, x% of a non oxidized bitumen with a penetrability that ranges between 20 and 900 and y% of an oxidized bitumen, with a penetrability that ranges between 10 and 90, where said penetrabilities are determined as set forth the NF standard T 66004 and are expressed in 1/10 mm, where the values of x and y are such that $20 \leq x \leq 95$ and $5 \leq y \leq 80$ with $x + y = 100$.

2. Method as set forth in claim 1, characterized in that the weight percentages x% of non oxidized bitumen and y% of oxidized bitumen, associated to form the bituminous matrix of the bitumen/polymer composition are such that $35 \leq x \leq 85$ and $15 \leq y \leq 65$ with $x + y = 100$.

3. Method as set forth in claim 1 or 2, characterized in that the quantity of precursor elastomer represents from 1.5% to 20% of the weight of the bituminous matrix.

4. Method as set forth in one of claims 1 through 3, characterized in that the non oxidized bitumen, entering in the making of the bituminous matrix, consist of one single bitumen or of a mixture of bitumens taken from among the straight-run bitumens, the refinery bitumens under reduced pressure, the propane or pentane deasphalting residues and viscosity breaking residues.

5. Method as set forth in claim 4, characterized in that the non oxidized bitumen is one bitumen or a mixture of bitumens taken from among the straight-run bitumens.

6. Method as set forth in one of claims 1 through 5, characterized in that the oxidized bitumen, associated with the non oxidized bitumen to make up the bituminous matrix, consists of one single oxidized bitumen or of a mixture of oxidized bitumens taken from among the blown bitumens and the semi-blown bitumens.

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7. Method as set forth in one of claims 1 through 6, characterized in that the penetrability of the non oxidized bitumen, used in making the bituminous matrix, ranges between 35 and 500 and especially between 160 and 330.

8. Method as set forth in one of claims 1 through 7, characterized in that the penetrability of the oxidized bitumen, used in making the bituminous matrix ranges between 20 and 60.

9. Method as set forth in one of claims 1 through 8, characterized in that the oxidized bitumen, associated with the non oxidized bitumen to make the bituminous matrix has a ring and ball softening point as defined in the NF standard T 66008, that ranges between 60°C and 120°C.

10. Method as set forth in one of claims 1 through 9, characterized in that the precursor elastomer consists of at least one copolymer chosen from among the random or block copolymers of styrene and of a conjugated diene, namely butadiene, isoprene, chloroprene, carboxylic butadiene or carboxylic isoprene.

11. Method as set forth in claim 10, characterized in that the precursor elastomer consists of one or several copolymers chosen from among the linear or star block copolymers, with or without a random hinge, of styrene and of butadiene, of styrene and of isoprene, of styrene and of chloroprene, of styrene and of carboxylic butadiene or alternatively of styrene and of carboxylic isoprene.

12. Method as set forth in claim 10 or 11, characterized in that the copolymers of styrene and of conjugate diene have a styrene content that ranges between 5% and 50% by weight.

13. Method as set forth in one of claims 10 through 12, characterized in that the copolymers of styrene and of conjugated diene have, prior to the cross-linking and/or functionalization, average molecular masses by weight that range between 10 000 daltons and 600 000 daltons and preferably between 30 000 daltons and 400 000 daltons.

14. Method as set forth in one of claims 1 through 13, characterized in that it consists in putting the non oxidized bitumen and the oxidized bitumen chosen to make the bituminous matrix in contact with, by weight of said matrix, 0.5% to 30% and preferably 1.5% to 20% of the precursor elastomer and 0.01% to 6% and more particularly 0.05% to 3%, of cross-linking agent and/or a functionalization agent while

working at temperatures that range between 100°C and 230°C and preferably between 130°C and 200°C and under agitation for a period of time of at least 5 minutes.

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15. Method as set forth in claim 14, characterized in that the precursor elastomer is put in contact with the non oxidized and the oxidized bitumens while working at temperatures ranging between 100°C and 230°C, preferably between 130°C and 200°C and under agitation for a period of time ranging from 5 minutes to 8 hours, in particular from 30 minutes to 6 hours, to create a homogenous mixture, then the cross-linking agent and/or functionalization agent is incorporated into said mixture and it is all kept under agitation at temperatures ranging between 100°C and 230°C, preferably between 130°C and 200°C, and identical or not to the temperatures at which the precursor elastomer is mixed with the non oxidized and the oxidized bitumens used to make the bituminous matrix, for a period of time that ranges between 5 minutes and 5 hours, more particularly between 10 minutes and 180 minutes, to form a reaction product that makes up the cross-linked and/or functionalized bitumen/polymer composition.

16. Method as set forth in one of claims 1 through 13, characterized in that it consists, in a first phase, in preparing a concentrate by putting from 50% to 100% of the non oxidized bitumen to be used to make the bituminous matrix in contact with, by weight of said matrix, 5% to 30% of the precursor elastomer and 0.01% to 6%, and more particularly 0.05% to 3%, of a cross-linking agent and/or a functionalization agent to form a cross-linked and/or functionalized bitumen/polymer reaction product that makes up said concentrate while working at temperatures ranging between 100°C and 230°C, and preferably between 130°C and 200°C, under agitation during a period of time of at least 5 minutes and then in, in a second phase in diluting the cross-linked and/or functionalization bitumen/polymer reaction that resulted from the first phase and adding to it the oxidized bitumen and the possible remaining fraction of non oxidized bitumen, while operating at temperatures that range between 100°C and 230°C, preferably between 130°C and 200°C, under agitation, to form the cross-linked and/or functionalized bitumen/polymer composition.

17. Method as set forth in claim 16, characterized in that the first phase is carried out by putting the precursor elastomer in contact with the non oxidized bitumen, while working at temperatures that range between 100°C and 230°C, preferably between

130°C and 200°C, and under agitation for a period of time from 5 minutes to 8 hours, namely from 30 minutes to 6 hours, to form a homogenous mass, then in adding to said mixture the cross-linking agent and/or functionalization agent and holding it all under agitation at temperatures that range between 100°C and 230°C, preferably between 130°C and 200°C and identical or not to the temperatures at which the precursor elastomer is mixed with the non oxidized bitumen, for a period of time that ranges from 5 minutes to 5 hours, more particularly between 10 minutes and 180 minutes, to form the cross-linked and/or functionalized bitumen/polymer reaction product.

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18. Method as set forth in one of claims 14 through 17, characterized in that the functionalized elastomer is created within the bituminous matter using a functionalization agent, namely a functionalization agent taken from among the carboxylic acids or esters bearing thiol or disulfide groupings or from among the thiolcarboxylic acid polyesters.

19. Method as set forth in one of claims 1 through 18, characterized in that the elastomer is functionalized and in that we incorporate one or several reactive additives likely to react with the functional groupings of the elastomer into the functionalized bitumen/polymer composition during its preparation where the quantity of the reactive additive(s) ranges from 0.01% to 10% and more particularly from 0.05% to 5% of the weight of the bitumen present in the composition.

20. Method as set forth in one of claims 14 through 17, characterized in that the cross-linked elastomer is created within the bituminous matrix, using a cross-linking agent, namely a cross-linking agent of the sulfur donor cross-linking agent type of the peroxidized compound type that generates free radicals at temperatures ranging between 100°C and 230°C.

21. Method as set forth in one of claims 1 through 20, characterized in that we incorporate one or several additional polymers that are different from the precursor elastomer to the cross-linked and/or functionalized bitumen/polymer composition in an overall quantity that ranges between 0.3% and 20% and preferably between 0.5% and 10% of the weight of the bitumen of said compositions.

22. Application of the compositions obtained by the method as set forth in any one of claims 1 through 21, as bituminous binders that can be used immediately or following an aqueous emulsion, to make pavements and in particular road surface

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pavements, namely of the top coating type, for the making of coated materials that are spread when hot or cold, or alternatively for the making of watertight facings.

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